

Use Attainability Analysis Queen Creek

Introduction/Background

On October 18, 1999, the BHP Copper Company Superior Division petitioned the Arizona Department of Environmental Quality (ADEQ) to change the designated use of a segment of Queen Creek in the Middle Gila River Basin. The segment of Queen Creek, subject of the petition, was from the Superior Mining Division discharge point to the Town of Superior Wastewater Treatment Plant. BHP Copper requested that this segment of Queen Creek be changed from effluent-dependent water (EDW) to ephemeral water.

BHP Copper stated in its request that it believed that the segment of Queen Creek upstream of the Town of Superior WWTP discharge was inappropriately classified as an EDW and that it should be designated as an ephemeral water. At the time the petition was submitted to ADEQ, R18-11-101(202) defined “ephemeral water” as a surface water that has a channel that is at all times above the water table and that flows only in direct response to precipitation.

Supporting Hydrologic Documentation

A report prepared on September, 2002, by Jones & Stokes for the Town of Superior regarding the riparian restoration of Queen Creek, describes Queen Creek as “a small, intermittent tributary stream within the Middle Gila River basin.” It further discusses information gathered from local residents of Superior regarding Queen Creek and the impact mining has had on its current condition as follows:

“Anecdotal information gathered previously from long-time residents of Superior (Jones & Stokes 2000) indicates that existing base flow conditions in Queen Creek appear to be less persistent compared to historical conditions. Specifically, pools in the creek a short distance upstream of the Magma Avenue bridge were reported to remain full of water all summer and served as popular swimming holes. However, the drought stress and mortality evident in cottonwood trees along the lower downtown area in Reach 2 suggest that the flow regime has become drier. The most likely cause of the decrease in base flow is seepage into underground mine working. Large amounts of Queen Creek flow reportedly leak into mine workings along the creek about 0.2 mile upstream of the Magma Club.” [p.3-4]

Attached Figure 2-1, Project Area from Jones & Stokes riparian restoration project show Magma Avenue and the location of Magma Club. Figure 3-1, Riparian Vegetation

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Communities illustrates the division of the reaches within the Superior city limits.

The Jones & Stokes report thoroughly discusses the hydrology within the area of Superior and its interconnection with Queen Creek as follows:

Historical dewatering operations of the BHP mine were effectively equivalent to an indirect diversion of streamflow from Queen Creek, since these operations were known to induce seepage from Queen Creek and intercept groundwater that would otherwise have been discharged to the creek [p.3-4].

Groundwater in the vicinity of Superior appears to be divided functionally into shallow and deep-flow systems that share a certain amount of interconnection. Information regarding the deep-flow system comes from observations of groundwater flow and levels in the mine workings, and information regarding the shallow system comes from domestic water wells and flow gains and losses in Queen Creek [p.3-7].

Because domestic wells in Superior are able to produce water from relatively shallow depths (<300 feet), there clearly is a shallow groundwater system associated with the Gila Formation. Because of its variable texture and degree of cementation, the primary permeability of the Gila Formation is probably quite variable but generally low. This level of permeability is consistent with the reportedly low yields of domestic wells that are completed in the formation. Water level resources from local wells within Superior suggest that the water table is fairly flat and slopes westward at the same gradient as the Queen Creek creekbed, and that the shallow groundwater system is hydraulically connected with the creek along most of its length [p. 3-7].

Gains and losses of streamflow resulting from the interaction between groundwater and the stream channel were estimated from direct field measurements and existing well water level records (Jones & Stokes 2000). Streamflow loss rates depend on the channel substrate characteristics and location of groundwater levels adjacent to the channel. Groundwater level records of nearby wells indicate that groundwater adjacent to all reaches of the channel in the project area is probably shallow during most months of the year [pp. 3-7, 3-8].

Information gathered from Arizona Department of Water Resources (ADWR) Well-55 database indicates that wells within the vicinity of Superior are as shallow as 10 feet below surface. Map 1 gives ranges and locations of well data gathered from ADWR [see also attached data from wells-55].

Information regarding shallow depths of wells and groundwater depth within the Superior area include:

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SW-13

This well is privately owned and is listed for domestic water use in the Department of Water Resources database. The well is located approximately 1,000 feet downgradient of the (Magma Copper Company-Superior) site. The well was drilled in 1907. The well is 30 feet deep and depth to groundwater in the well is approximately 15 feet bls which suggests that groundwater samples were drawn from the shallow portion of the aquifer. This well was not equipped with a dedicated pump [p. 39].

SW-18

This well is privately owned and the listed water use in the Department of Water Resources database is domestic. The well is located approximately 500 feet downgradient of the (Magma Copper Company-Superior) site. The well was drilled in 1958. The well is 80 feet deep and depth to groundwater in the well is approximately 20 feet bls which suggests that groundwater samples were drawn from the shallow portion of the aquifer. [p. 40].

A voluminous series of conglomerates that overlies all older rocks in the area and is older than the present alluvial valley fill is known as the Gila Conglomerate. In general the Gila Conglomerate is a collection of angular to subangular fragments of pebble and cobble size clasts in a coarse-grained poorly sorted sand of quartz, feldspar and rock fragment. (3) This Gila Conglomerate is the water producing horizon in the Superior area. Depth to water in and around Superior ranges from 10 to over 100 feet below land surface. (5) [p. 53].

Dewatering

Active dewatering of the BHP Copper, Superior Division mine has ceased. An Underground Mine Water Monitoring Plan was approved on October 13, 1998 by ADEQ. BHP engaged Brown and Caldwell to submit annual summary reports recording the water quality results and the water level recovery. Continuation of monitoring will proceed until recovery of the water level is achieved or if dewatering is once again reinitiated. Brown and Caldwell reports as of March 27, 2002:

Dewatering of the Superior underground mine was discontinued on May 6, 1998. At the time the pumps were shut off, the water level at the No. 9 shaft was reported at the 4,180 level or at a depth of 4,028 feet below land surface (bls). It was estimated that complete recovery of the water level would not occur for a period of at least 10 years based on the water level reported at the time the pumps were shut off and historical water level recovery rates measured by BHP during previous mine flooding.

The water level in the No. 9 Shaft as of January 31, 2002, was reported at a depth of 3,011 feet bls, which corresponds approximately to the 2,431 mine level. Based

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on the data collected, the water level in the No. 9 Shaft rose at an average rate of approximately 1.0 foot per day based on the 12 months preceding January 31, 2002. This level is consistent with the prior year, which reported a water level rise of 0.9 foot per day.

The water level in the No. 3 Shaft, was recorded by the transducer and calculated by Brown and Caldwell on April 24, 2001, was reported at 2,440 feet bls relative to the No. 3 Shaft collar, which corresponds approximately to the 2,592 mine level. On January 31, 2002, the water level in the No. 3 Shaft was estimated at a depth of 2,257 bls, which corresponds approximately to the 2,409 mine level. This results in a rate of rise over that 283-day period of approximately 0.65-foot per day.

As of October 2, 2002, mine level for Shaft No. 9 was reported at 2,340 ft and Shaft No. 3 was reported at 2,325 ft [see Table 1].

Although BHP has requested the reclassification of Queen Creek to ephemeral, personal communication with mine staff indicate there is a possibility of future mining operations and possible future discharges. ADEQ met with William Gray and Dave Lira on February 3, 2003 and discussed the current exploration efforts by Kennecott Copper Corporation. Dewatering of Shaft No. 9 is contingent on the feasibility studies currently in progress by Kennecott.

The Jones & Stokes report also discusses the possibility of dewatering and its effects on Queen Creek.

The future ownership and operation of the BHP mine is presently uncertain. BHP has put this mine and several others up for sale, but a purchase has not been finalized. The outcome of this transaction will undoubtedly affect future mine operations and feasibility of implementing restoration and recreation development actions on parcels owned by the mine. Also uncertain is whether dewatering will be resumed to prevent the underground shafts and tunnels from filling with water while additional mine exploration activities take place. At the present rate of water-level rise in the mine, it would be necessary to resume dewatering sometime in 2000 to prevent one of the more important tunnels from flooding. Future mine ownership and operation will also determine whether a new dewatering water treatment system is constructed, which could tremendously increase the amount of water available for supplemental flow in Queen Creek [p. 5-1].

On November 1, 2002, ADEQ issued a clarification of AAC R18-11-113E, stating that any discharges, other than storm water to an ephemeral surface water, will be required to meet EDW water quality standards. This clarification is to aid ADEQ permit writers in issuing AZPDES permits and applies to both discharges from domestic POTWs and industrial discharges. AAC R18-11-113E states that the permitting authority shall use EDW standards when developing permit limits for discharges to ephemeral waters that turn that

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water body into an effluent dependent water body.

Permits

Compliance

ADEQ, Water Quality Division-Water Quality Compliance Section inspected the BHP Copper - Superior Operations on June 25, 2001. Their report includes:

BHP Copper has located a large copper deposit near the old workings. As part of the exploration process, it may be necessary to resume dewatering operations to facilitate the exploration efforts. Therefore, BHP Copper wants to keep its NPDES permit and is now in the process of obtaining an operating APP permit instead of a closure permit.

ADEQ Waste Programs Division, Capacity Development Section, Site Assessment Unit, Scott Goodwin and Mary Hessler, prepared an Expanded Site Inspection Report of the Magma Copper Company-Superior Site (also known as BHP) requested by the U.S. Environmental Protection Agency (EPA). A site inspection was necessary in part due to “shallow depth to groundwater,” as stated by EPA.

The Site Inspection report describes the shallow and deep aquifer systems:

A comparison of water levels for wells on top of the mudstone (MCC_2, MCC-3Am MCC-9, ADOT, Hotel) versus wells screened below the mudstone or beyond the mudstone extent (MCC1, MCC-5A, MCC-6B, MCC-3C, Mcc-4, Neary, Ruiz) indicates there are two flow systems. The first contour set represents the water table for the shallow unconfined groundwater on top of the mudstone, and is referred to as the shallow aquifer system. The second contour set represents the water table and the piezometric surface for the unconfined to semi-confined groundwater below the mudstone and beyond the mudstone, extent, referred to as the deep aquifer system. (5) [p. 14]

NPDES No. AZ0020389

BHP Copper Inc., Superior Division NPDES Permit No. AZ 0020389 was authorized on November 7, 2000. The NPDES Permit authorizes the discharge of treated mine process water, mine drainage and storm water. The NPDES permit requires BHP Copper to conduct annual bioassessments of Queen Creek to assess the effectiveness of pollution control measures. NPDES Permit, Section III, part 3, states, “The current bioassessment

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is conducted in May, a time of year where surface flows in Queen Creek are intermittent and surface water habitat in Queen Creek is usually composed of a number of variously sized pools.” The Cadmus Group, Inc. was engaged by BHP Copper to conduct their annual bioassessment and began conducting them in 1994. These assessments describe the characteristics of Queen Creek. ADEQ has reviewed the Cadmus reports for the years 1999, 2000, and 2001. As noted earlier, in the 2000 and 2001 assessments, photos show large ponds of standing water.

A comparison with precipitation data provided by the National Weather Service Cooperative Weather Observers, Summary of the Day, from the National Climatic Data Center, NOAA, Dept. of Commerce and formatted by the Western Region Climate Center have been used in conjunction with the bioassessment to try and assess the source of the standing pools.

The 1999 Bioassessment was conducted on May 5, 1999. The 1999 Bioassessment describes QCAMP1 as having “contained one 10m pool.” It further describes QCAMP2 as having water present in a few pools. Further reference is made to the presence of more pools of water at QCAMP2. No photos are present nor is there any reference to the number of pools in the QCAMP2 area.

The 2000 Annual Bioassessment was conducted on March 29th & 30th. The bioassessment refers to the status of both sites, QCAMP1 and QCAMP2, as having pools of water. The bioassessment further discusses that, “Because the SMD (Superior mine discharge) discharge has ceased, only a few small pools had permanent water.” Photos indicate little water present at QCAMP1 with a significant amount of algae. Photos of QCAMP2 indicate a substantial amount of water present. Taxa studied in this bioassessment are consistent with intermittent stream flows.

The following table provides the precipitation data on and 30 days prior to May 5, 1999 and May 29, 2000.

DATE (year 1999)	PRECIPITATION (in inches)	DATE (year 2000)	PRECIPITATION (in inches)
04/01/99	.21	02/29/00	0
04/02/99	1.49	03/01/00	0

04/03/99	.25	03/02/00	0
04/04/99	.18	03/03/00	0
04/05/99	.71	03/04/00	.27
04/06/99	0	03/05/00	1.2
04/07/99	0	03/06/00	1.0
04/08/99	.02	03/07/00	.11
04/09/99	0	03/08/00	0
04/10/99	0	03/09/00	0
04/11/99	0	03/10/00	0
04/12/99	0	03/11/00	0
04/13/99	.05	03/12/00	0
04/14/99	0	03/13/00	0
04/15/99	0	03/14/00	0
04/16/99	0	03/15/00	0
04/17/99	0	03/16/00	0
04/18/99	0	03/17/00	0
04/19/99	0	03/18/00	0
04/20/99	0	03/19/00	0
04/21/99	0	03/20/00	0
04/22/99	0	03/21/00	0
04/23/99	0	03/22/00	0
04/24/99	0	03/23/00	0
04/25/99	0	03/24/00	0
04/26/99	0	03/25/00	0
04/27/99	0	03/26/00	0
04/28/99	0	03/27/00	0
04/29/99	0	03/28/00	.28
04/30/99	0	03/29/00	0
05/01/99	0	03/30/00	0
05/02/99	0	03/31/00	0
05/03/99	0	04/01/00	0
05/04/99	0	04/02/00	0
05/05/99	0	04/03/00	0

Aquifer Protection Permit

BHP Copper submitted for an Aquifer Protection Permit (APP) on August 2, 1999. The Project Description reads:

The BHP Copper Superior Operation is seeking an area-wide APP for existing discharging facilities located at the Superior mine complex. The Superior mine

has been inactive since 1996. Dewatering of the underground mine was suspended in May 1998. The facilities listed in the APP will remain in operation during future exploration of the deep Magma porphyry beneath the existing underground mine workings. The proposed work will involve dewatering of the Superior mine, treatment and disposal of mine water, and removal and surface storage of new excavated exploration and development rock extracted from the mine.

Upon reviewing the application, ADEQ's Water Permits Section determined:

The WPS-MU has determined that the underground mine is not a discharging facility at this time and is exempt from APP requirements. The WPS-MU, however, is concerned that once closure is attained and the mine allowed to flood, that the facility will eventually discharge into Queen Creek. Based on maps provided by BHP Copper Superior Operations, the WPS-MU believes that the mine could discharge if the water level is allowed to reach an elevation of approximately 2900 feet above mean sea level (AMSL). Therefore, BHP Copper Superior Operations should provide an addendum to the Closure/Post-Closure plan to address how this concern will be handled.

Conclusion

Historically, Queen Creek's surface flow was perennial and was an integral source of water and sediment supply to the East Salt River Valley Basin (Goodwin, 2001). The intensive pumping due to mine dewatering in combination with the drought stress has artificially altered Queen Creek.

Two alternative paths exist for the future of Queen Creek:

- (1) Should further exploration continue at BHP Copper, Superior Division, dewatering will once again recommence which requires an AZPDES permit.
- (2) Should copper prices remain at their present state and BHP Copper, Superior Division operations terminate altogether, the shafts will eventually fill resulting in their discharging into Queen Creek. Since it is mine discharge, an AZPDES permit will be required. Given indications of groundwater levels rising, ADEQ finds it would not be reasonable to reclassify the above mentioned segment of Queen Creek from effluent-dependent water (EDW) to ephemeral as requested by BHP. Rather, the supporting data suggests it is likely more appropriate to redesignate Queen Creek as an intermittent, aquatic and wildlife warm (A&Ww) water segment.

ADEQ requests that EPA defer action on the reclassification of Queen Creek at this time. The TMDL unit is currently in the preliminary stages of a TMDL investigation for copper along this stretch of Queen Creek. ADEQ believes it will have sufficient evidence of the

hydrologic status of Queen Creek available in conjunction with the next TMDL - anticipated to commence in 2005.

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References

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